

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 29 SEP 2005

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Applicant's or agent's file reference BPCL 9921	FOR FURTHER ACTION		See Form PCT/PEA416																								
International application No. PCT/GB2004/002069	International filing date (day/month/year) 13.05.2004	Priority date (day/month/year) 05.06.2003																									
International Patent Classification (IPC) or national classification and IPC C07C51/215, C07C51/25, C07C67/05, C07C67/035, C07C53/08, C07C69/01, C07C69/14, C07C51/295																											
Applicant BP CHEMICALS LIMITED																											
<ol style="list-style-type: none"> 1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of 9 sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: <ol style="list-style-type: none"> a. <input type="checkbox"/> sent to the applicant and to the International Bureau a total of sheets, as follows: <ul style="list-style-type: none"> <input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions). 																											
<ol style="list-style-type: none"> 4. This report contains indications relating to the following items: <table style="width: 100%; border: none;"> <tr> <td style="width: 10%;"><input checked="" type="checkbox"/></td> <td style="width: 15%;">Box No. I</td> <td>Basis of the opinion</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> 				<input checked="" type="checkbox"/>	Box No. I	Basis of the opinion	<input type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input checked="" type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input type="checkbox"/>	Box No. VII	Certain defects in the international application	<input type="checkbox"/>	Box No. VIII	Certain observations on the international application
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Date of submission of the demand 09.12.2004		Date of completion of this report 28.09.2005																									
Name and mailing address of the international preliminary examining authority: <div style="display: flex; align-items: center;"> <div> European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 </div> </div>		Authorized Officer Lorenzo Varela, M.J. Telephone No. +49 89 2399-8239																									



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/GB2004/002069

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

1-18 as originally filed

Claims, Numbers

1-33 as originally filed

Drawings, Sheets

1/2-2/2 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/GB2004/002069

Box No. IV Lack of unity of invention

1. ☒ In response to the invitation to restrict or pay additional fees, the applicant has:
- ☐ restricted the claims.
 - ☒ paid additional fees.
 - ☐ paid additional fees under protest.
 - ☐ neither restricted nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
 - ☒ not complied with for the following reasons:
see separate sheet
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☒ all parts.
 - ☐ the parts relating to claims Nos. .

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	3,10-12,14,15
	No: Claims	1,2,4-9,13,16-33
Inventive step (IS)	Yes: Claims	
	No: Claims	1-33
Industrial applicability (IA)	Yes: Claims	1-33
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item IV

Lack of unity of invention

1. The present application does not fulfil the requirements of Rule 13 PCT, the reason being that the present application relates to several inventions, namely:

1. Claims 1,2,4-22(part),23,24-33(part)

Process for the oxidation of a C2 to C4 alkane to produce the corresponding alkene and carboxylic acid and/or for the oxidation of a C2 to C4 alkene to produce the corresponding carboxylic acid, the process comprising feeding to an oxidation reaction zone said alkane and/or alkene, a molecular oxygen-containing gas, carbon monoxide and optionally water, in the presence of a catalyst to produce a first product stream containing alkene and carboxylic acid, characterised in that said carbon monoxide is maintained at between 1% and 20% by volume of the total feed to the oxidation reaction zone and possibly further comprising contacting in a second reaction zone at least a portion of said alkene and at least a portion of said carboxylic acid obtained from the oxidation reaction zone and a molecular oxygen-containing gas, in the presence of a catalyst to produce a second product stream comprising alkenyl carboxylate.

2. Claims 3,4-22(part),24-33(part)

Process for the oxidation of a C2 to C4 alkane to produce the corresponding alkene and carboxylic acid and/or for the oxidation of a C2 to C4 alkene to produce the corresponding carboxylic acid, the process comprising feeding to an oxidation reaction zone said alkane and/or alkene, a molecular oxygen-containing gas, carbon monoxide and optionally water, in the presence of a catalyst to produce a first product stream containing alkene and carboxylic acid, characterised in that said carbon monoxide is maintained at between 1% and 20% by volume of the total feed to the oxidation reaction zone and further comprising contacting in a second reaction zone at least a portion of said alkene and at least a portion of said carboxylic acid obtained from the oxidation reaction zone and a molecular oxygen-containing gas, in the presence of a catalyst to produce a second product stream comprising alkyl carboxylate.

2. A situation of lack of unity has been found. The reason therefore is that a process for the oxidation of a C2 to C4 alkane to produce the corresponding alkene and carboxylic acid and/or for the oxidation of a C2 to C4 alkene to produce the corresponding carboxylic acid, the process comprising feeding to an oxidation reaction zone said alkane and/or alkene, a molecular oxygen-containing gas, carbon monoxide and optionally water, in the presence of a catalyst to produce a first product stream containing alkene and carboxylic acid, characterised in that said carbon monoxide is maintained at between 1% and 20% by volume of the total feed to the oxidation reaction zone is known in the state of the art (D1-D2). Therefore, there is no technical feature linking both inventions which can be regarded as a special technical feature in the sense of Rule 13.1 PCT. Hence, the application is not unitarian.

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. The following documents are referred to in this communication:

D1 : WO 01/90043 A (ZEYSS SABINE ; AVENTIS RES & TECH GMBH & CO (DE);
DINGERDISSEN UWE (DE) 29 November 2001 (2001-11-29)
D2 : WO 01/90042 A (ZEYSS SABINE ; AVENTIS RES & TECH GMBH & CO (DE);
DINGERDISSEN UWE (DE) 29 November 2001 (2001-11-29)
D3 : US 6 156 928 A (KHAN ASAD ET AL) 5 December 2000 (2000-12-05)
D4 : US 6 143 921 A (KARIM KHALID ET AL) 7 November 2000 (2000-11-07)
D5 : EP 1 201 631 A (BP CHEM INT LTD) 2 May 2002 (2002-05-02)
D6 : EP 1 201 630 A (BP CHEM INT LTD) 2 May 2002 (2002-05-02)
D7: EP-A-0 926 126 (BP CHEM INT LTD) 30 June 1999 (1999-06-30)
D8: US-B-6 180 8211 (WATSON DERRICK JOHN ET AL) 30 January 2001 (2001-01-30)
D9: US-A-6 040 474 (WATSON DERRICK JOHN ET AL) 21 March 2000 (2000-03-21)
D10: US-B-6 670 504 (ROESKY RANIER ET AL) 30 December 2003 (2003-12-30)

First invention

2. The first invention, claims 1,2,4-22(part),23,24-33(part), relates to a process for the oxidation of a C2 to C4 alkane to produce the corresponding alkene and carboxylic acid and/or for the oxidation of a C2 to C4 alkene to produce the corresponding carboxylic acid, the process comprising feeding to an oxidation reaction zone said alkane and/or alkene, a molecular oxygen-containing gas, carbon monoxide and optionally water, in the presence of a catalyst to produce a first product stream containing alkene and carboxylic acid, characterised in that said carbon monoxide is maintained at between 1% and 20% by volume of the total feed to the oxidation reaction zone and possibly further comprising contacting in a second reaction zone at least a portion of said alkene and at least a portion of said carboxylic acid obtained from the oxidation reaction zone and a molecular oxygen-containing gas, in the presence of a catalyst to produce a second product stream comprising alkenyl carboxylate.

Novelty

3. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1, 2, 4-9, 13 and 16-33 is not new in the sense of Article 33(2) PCT.
- 3.1. D1 and D2 disclose a process for the oxidation of ethane in the presence of a catalyst to obtain a reaction mixture comprising acetic acid, carbon monoxide, carbon dioxide, water and ethylene, separating acetic acid and carbon dioxide and recycling ethane, ethylene and carbon monoxide to the oxidation reaction zone, the process further comprising the reaction of ethylene and acetic acid in the presence of a catalyst to produce vinyl acetate. Carbon monoxide is obtained in an amount of up to 5% by volume of the total feed to the oxidation reaction zone and is recycled (see the passages mentioned in the search report). These disclosures anticipate the subject-matter of claims 1, 2, 4-9, 13 and 16-33, which is therefore not novel.
- The applicant argues that D1 and D2 do not disclose that the amount of CO fed to the oxidation reactor has to be maintained within the specified range in the application. The applicant's attention is drawn to D1: page 7, last paragraph and page 13, last paragraph

and D2: page 5, last paragraph and page 9, third paragraph, wherein the amount of carbon monoxide is maintained up to 5% (if a higher amount of carbon monoxide is produced, it is removed) and the stream containing carbon monoxide is recycled to the first or second reaction zone.

Inventive step

4. The subject-matter of claims 10-12, 14 and 15 cannot be considered to involve an inventive step in the sense of Art. 33(3) PCT.

Processes for the oxidation of ethane in the presence of a catalyst to obtain a reaction mixture comprising acetic acid, carbon monoxide, carbon dioxide, water and ethylene, separating acetic acid and carbon dioxide and recycling ethane, ethylene and carbon monoxide to the oxidation reaction zone, the process further comprising the reaction of ethylene and acetic acid in the presence of a catalyst to produce vinyl acetate and wherein carbon monoxide is obtained in an amount of up to 5% by volume of the total feed to the oxidation reaction zone and is recycled, are known in the art (see D1 and D2). Taking into account that according to the results shown in the tables in those documents higher selectivities in acetic acid and vinyl acetate than in the application are obtained and lower selectivity in CO_x byproducts is shown, an inventive step cannot be acknowledged to the subject-matter of claims 10-12, 14 and 15.

Second invention

5. The second invention, claims 3, 4-22(part) and 24-33(part), discloses a process for the oxidation of a C2 to C4 alkane to produce the corresponding alkene and carboxylic acid and/or for the oxidation of a C2 to C4 alkene to produce the corresponding carboxylic acid, the process comprising feeding to an oxidation reaction zone said alkane and/or alkene, a molecular oxygen-containing gas, carbon monoxide and optionally water, in the presence of a catalyst to produce a first product stream containing alkene and carboxylic acid, characterised in that said carbon monoxide is maintained at between 1% and 20% by volume of the total feed to the oxidation reaction zone and further comprising contacting in a second reaction zone at least a portion of said alkene and at least a portion of said carboxylic acid obtained from the oxidation reaction zone and a

molecular oxygen-containing gas, in the presence of a catalyst to produce a second product stream comprising alkyl carboxylate.

Novelty

6. The subject-matter of claims 3, 4-22(part) and 24-33(part) is novel in the sense of Art. 33(2) PCT. None of the available documents of the prior art discloses an integrated process for the production of alkyl carboxylate and carboxylic acid and possibly alkene from a C2 to C4 alkane and/or C2 to C4 alkene according to claims 3,4-22(part) and 24-33(part).

Inventive step

7. The subject-matter of claim 3 cannot be considered to involve an inventive step in the sense of Art. 33(3) PCT. Taking into account that the production of alkyl carboxylate from an alkene and a carboxylic acid is well known in the art (see D5, D6 and D7), the integration of this process with the production of a carboxylic acid and possibly an alkene according to the processes in D1-D4 disclosed above would be obvious for the skilled person in the art, specially taking into account that D5 and D6 explicitly disclose integrated processes. Hence, an inventive step cannot be acknowledged.
8. Processes for the oxidation of ethane in the presence of a catalyst to obtain a reaction mixture comprising acetic acid, carbon monoxide, carbon dioxide, water and ethylene, separating acetic acid and carbon dioxide and recycling ethane, ethylene and carbon monoxide to the oxidation reaction zone, the process further comprising the reaction of ethylene and acetic acid in the presence of a catalyst to produce vinyl acetate and wherein carbon monoxide is obtained in an amount of up to 5% by volume of the total feed to the oxidation reaction zone and is recycled, are known in the art (see D1 and D2). Taking into account that according to the results shown in the tables in those documents higher selectivities in acetic acid and vinyl acetate than in the application are obtained and lower selectivity in CO_x byproducts is shown, and in view that the integration of the manufacture of alkyl carboxylate or alkenyl carboxylate are obvious alternatives for the skilled person in the art (see D5 and D6), an inventive step cannot be acknowledged to the subject-matter of claims 10-12, 14 and 15.

Further comments

9. D10 discloses a process for the oxidation of ethane in the presence of a catalyst to obtain a reaction mixture comprising acetic acid, carbon monoxide, carbon dioxide, water and ethylene, separating acetic acid and carbon dioxide and recycling ethane, ethylene and carbon monoxide to the oxidation reaction zone. Carbon monoxide is obtained in an amount of up to 5% by volume of the total feed to the oxidation reaction zone and is recycled. This document can become very relevant to assess the patentability of the present application when it enters the national/regional phase. No check has been made as to whether the priority of the present application has been validly claimed.
10. The use of the term "approximately" in claim 22 and in the description renders unclear the scope of the protection sought, contrary to Art. 6 PCT.
11. The use of the term "essentially" and "substantially" in the description renders unclear the scope of the protection sought, contrary to Art. 6 PCT.
12. The terms "the contents of which are hereby incorporated by reference" used in the description render unclear the scope of the protection sought, contrary to Art. 6 PT.
13. The units "psig" used in the description are not additionally expressed in terms of the units stipulated by Rule 10.1/(a)/and/(b) PCT.
14. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1-D7 is not mentioned in the description, nor are these documents identified therein.